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ABSTRACT

The great concern in recent decades over the trends of declining student achievement scores and increased cost of schooling has prompted speculation about how these trends might relate to one another. Much like popular opinion, research findings from studies of this relationship have often been contradictory. This study presents results from a meta-analysis of research on the relationship between educational expenditure and student achievement. Meta-analysis refers to the analysis of analyses and is the statistical analysis of a large collection of analysis results from individual studies for the purpose of integrating findings. Forty-five studies of this area were examined, representing 417 correlation coefficients from 1928 to 1980. The analysis shows that educational expenditures have little effect on student achievement. Noted is a trend that involves the decline in the relationship of the two factors over several decades. Evidence of an interaction of grade level with the relationship is not present. Conclusions and recommendations for further research are provided. Included in the study are 6 tables of statistical data and 12 references. A complete listing of studies used is provided. (WTH)

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A META-ANALYSIS OF RESEARCH ON THE RELATIONSHIP BETWEEN EDUCATIONAL EXPENDITURES AND STUDENT ACHIEVEMENT

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Abstract

This article presents results from a meta-analysis of research on the relationship between educational expenditures and student achievement. The data for the meta-analysis came from 45 studies representing 417 correlation coefficients. The analysis showed that educational expenditures had little effect on student achievement. An important trend in the educational expenditure-student achievement relationship is the decline of the relationship over decades. There was no evidence of an interaction of grade level(s) with the educational expenditure-student achievement relationship.

INTRODUCTION

There has been great concern in recent decades with both the declining achievement scores of students and the increase in the cost of schooling. Some have linked two trends and have questioned whether additional spending results in increased achievement. For instance, journalist John Hildebrand (1977) declared that many taypayers have been left with the uneasy feeling that they are paying more for less. His views are not isolated, and consequently at budget time many school administrators and teachers have felt the heat. More recently, the National Commission on Excellence in Education (1983) proclaimed that the educational foundations of our society are presently being eroded by a "rising tide of mediocrity" that threatens our very future as a nation and as a people. President Reagan used this report as evidence that increased money for education has resulted in decreased achievement (Weisman, 1983).

At odds with the Reagan position are those who believe that if a school district were to spend more funds for instruction, then achievement scores of students would improve. Others decry a casual relationship at all, pointing out that the interplay of achievement and school finance in a complex event related to societal factors. Relatedly, educators have argued that if funds were more equitably allocated by the state, districts with a low tax base would be able to effect greater student achievement because of greater expenditures and opportunities which could be provided for their students. This belief has the support of a number of court decisions involving equitable financing in California (Serrano v. Priest), in New York (Levittown v. Nyquist), and in Texas (Rodriguez v. San Antonio Independent School District). In response to these contrasting views of

the relationship between financial aid to schools and student achievement, a great deal of research has been generated to discover the relationship between educational spending and student achievement. But much like popular opinion, the research findings presented in these studies have often been contradictory.

Studies concerning the relationship between educational expenditures and student achievement fall into one of three categories: studies which indicate no relationship, studies which indicate a positive relationship, and studies which indicate a positive relationship only under specified condition. From a survey of 45 major studies on this issue it was determined that 19 studies reported no relationship, 14 studies found a positive relationship, and 12 studies indicated a positive relationship under certain conditions.

There is confusion, in the research literature concerning the relationship between expenditures and student achievement scores. Clarification of the relationship between educational expenditures and student achievement is needed so that educators and policy makers will be better able to understand the effect of educational expenditures on student achievement. What is clear from the number of studies undertaken on this topic and the confusion that still exists, is that another primary study will not clarify the relationship between educational expenditures and student achievement. Since there is much rich data already available, a synthesis of the primary studies is in order, and the most appropriate synthesis technique for the data available is meta-analysis.

Meta-analysis refers to the analysis of analyses and is the statistical analysis of a large collection of analysis results from individual studies for the purpose of integrating findings (Glass, 1976).

Glass, McGraw, and Smith (1981) point out the advantages of using meta-analysis: numbers and statistical methods are used in a practical way for organizing and extracting information from large masses of data that are really incomprehensible by other means; an important part of every meta-analysis is the recording of methodological weaknesses in the original studies and the examination of their relationship to study findings; meta-analysis makes use of mulivariate data analysis for simultaneously studying the association in variations in research study characteristics with variation in the findings.

Using meta-analysis as the tool, the purpose of this study was to synthesize existing studies to determine the relationship between the amount of money a school district spends for education and student achievement scores. The investigation was guided by the following questions:

(1) What is the relationship between educational expenditures and student achievement?

(2) Under what conditions, if any, does additional spending lead to higher achievement scores?

(3) Does the effect of the educational expenditures on student achievement interact with grade level?

DESIGN OF THE STUDY

In this study, meta-analysis involved three interrelated sequential phases to address the three research questions.

Phase I: Sample Selection

Phase I provided the framework for identification of the studies to be included. The search for educational expenditure and student achievement studies was carried out in three places: (1) document

retrieval and abstract resources; (2) previous reviews of educational expenditures-student achievement literature; and (3) the bibliographies of studies. The Current Index to Journals of Education (CIJE) from 1969 to 1982, Dissertation Abstracts from 1861-1968 and Dissertation Abstracts International from 1969-1981, the Educational Resources Information Center (ERIC) from 1956-1982, and the Education Index from 1929-1982 were individually searched using the key words of academic achievement, academic performance, achievement, achievement gain, achievement gains, cost effectiveness, cost per pupil, cost per student, costs, educational achievement, educational improvement, educational performance, educational quality, expenditures per pupil, expenditures, mathematics achievement, pupil achievement, pupil expenditure, pupil improvement, pupil performance, reading achievement, scholastic achievement, school district spending, student achievement, and student performance. As a check, a computer search of Dissertation Abstracts, Dissertation Abstracts International, and Educational Resources Information Center was run using the keywords listed.

Sixty-seven dissertations and 400 other publications were located which studied the relationship between educational expenditures and student achievement. All were read to determine if they were appropriate for inclusion in this meta-analysis. Studies were included if they met the following requirements: those studies involving educational expenditures and student achievement which used an *r* statistic (correlation coefficient) or a statistic that was convertible to an *r* statistic (*F* or *t*); those studies in which statistics for all relationships studied were available; those studies in which the actual scores of students on achievement tests were used to determine the

relationship between educational expenditures and student achievement; and those studies in which individuals, school districts, or schools were used as the sample. Of the 467 studies, 45 (29 dissertations and 16 other publications) met the requirements.

From the 45 studies there were 417 correlation coefficients (cases) to be synthesized. A study could produce a number of cases due to its examination of different grade levels, achievements tested, and expenditure definitions. For example, Armstrong, Curtis, and Wohlferd (1968) reported on two grade levels, three achievement tests, and two expenditure definitions for a total of 12 correlation coefficients (cases).

Phase II: Description of Studies

Phase II was the quantification of the characteristics of the studies to permit eventual statistical description of how the properties of the studies affected the findings. The identification of those properties of the studies that might interact with the relationship between educational expenditures and student achievement were divided into five categories: study identification, achievement, demographics, expenditures, and outcome variable. The five categories were subdivided into 17 subcategories: source of data, year of publication, dates of research study, quality score, quality score adjustment, achievement tested, achievement grouping, achievement test(s), grade level(s), level of data, sample size, type of student grouping, expenditure definition, type of score, sign of correlation coefficient, r statistic, and source of r statistic.

In the quantification of the subcategory of source of data there were four sources: book, dissertation, journal article, and research/

government report. The most numerous cases involved dissertations (237), while the least involved books (5).

The publication years of the studies in this meta-analysis ranged from 1928 to 1980, while the quantification of the dates of research studies ranged from the earliest date of study 1922-23, until the latest date of study 1978-79.

Quality scores were derived from the aggregate score for each study obtained on the Quality Instrument. The Quality Instrument analyzed the studies on eight aspects of the research resulting in an overall quality score for each study. These eight aspects were developed from the general literature on the evaluation of research (Borg & Gall, 1979; Saffer, 1983; and Shakeshaft, 1979).

Quality scores were divided into adjusted and unadjusted scores. Adjusted scores referred to those studies in which there was no review of literature and the quality scores of those were adjusted for the missing review section. Many of the studies in books, journals, and research/government reports published only the findings of their study. The quality score adjustment was made so that these studies would not be penalized for the missing review of literature section. Unadjusted quality scores referred to those studies that had all sections as measured by the Quality Instrument. There were 95 adjusted and 322 unadjusted quality scores based on the 417 cases.

The quantification of the achievement tested resulted in 37 types of achievement. The most numerous types of achievement tested were reading (142), composite (74), and mathematics (32).

There were five achievement groupings: apprehension, composite (combination of achievement test scores from different achievement

groupings), language arts, math, and science. The qualification of the five achievement groupings ranged from 11 cases in science to 218 cases in language arts.

There were 26 different or combinations of tests used in the studies. The most common achievement tests were the Minimum Basic Skills Test (96 cases), the Stanford Achievement Test (51 cases), the Iowa Test of Basic Skills (36 cases), the Iowa Test of Educational Development (35 cases), and the California Achievement Test (35 cases).

Data for 15 grade levels exsisted with the most numerous number of cases for grades 3 (51), 5 (57), 6 (61), 9 (65), 11 (55), and 12 (57).

All data exsisted at the individual, school, or school district level. The majority of cases were at the school district level (330 cases), followed by individual (77 cases), and school (20 cases).

The sample sizes of the studies synthesized proved to be quite varied, ranging from 87 to 2,205,319. School district samples were from 9 to 705 districts and schools ranged from 34 to 1,701. These samples were national, statewide, regional, or local. Statewide assessment was the most common method (309 cases), while local assessment was the least (14 cases).

Researchers defined expenditures 13 different ways. The most common expenditure definitions were current expenditures (126 cases) and instructional costs (123 cases).

Results were either presented using mean correlation coefficients (400 cases) or median correlation coefficients, (17 cases) The subcategory of sign indicated if the correlation coefficient was positive or negative. There were 298 positive correlations and 119 negative ones. The quantification of the $\underline{r}$ statistic ranged from -.7900 to +.6114. In 402 cases the

r statistic was the statistic used in the original study while in 15 cases, a conversion was required.

Phase III:Synthesis

The analysis of the studies was undertaken to determine the relationship between educational expenditures and student achievement. Phase III was divided into five parts: the magnitude of the mean and median correlations between educational expenditures and student achievement, the test of homogeneity of correlations, the test to determine if the homogeneous correlations were different from zero, multiple regression analysis, and the model specification test.

FINDINGS

What is the relationship between educational expenditures and student achievement?

The results of the meta-analysis showed a small amount of variance, (1.04%), in the reported correlation between educational expenditures and student achievement in studies using mean correlations (n = 400). Instructional costs (school districts) and instructional costs divided by weighted average daily attendance (WADA) produced the largest amount of variance among the educational expenditures accounting for 6% and 9% of the variance respectively (see Table 1). In studies involving median correlations (n = 17) the amount of variance accounted for was 5% with correlation coefficients ranging from .0400 to .4631 with an overall correlation of .2301 and a standard deviation of .1410 (see Table 2).

The explanatory variables coded for each study accounted for little of the overall variance. These explanatory variables included source of data, dates of research study, expenditure definition, achievement

Table 1

Magnitude of Mean Correlation Between Educational Expenditures and Student Achievement Accounted for by Educational Expenditures

Expenditure definition	Level	z	r	r^2	SD	n
All expenditures	All	.1023	.1023	.0104	.2433	400
Current expenditures	All	.0398	.0398	.0015	.3318	112
Current expenditures less transportation	School district and schools	.0214	.0214	.0004	.2399	67
Instructional costs	Individual and school district	.1590	.1580	.0249	.1622	124
Instructional costs	Individual	.0733	.0733	.0054	.0848	66
Current expenditures	Individual	.0445	.0445	.0019	.1073	11
Instructional costs and current expenditures	Individual	.0727	.0727	.0052	.0881	77
Current expenditures	Schools	.1383	.1373	.0188	.6556	3
Current expenditures less transportation	Schools	.1748	.1728	.0298	.1097	6
Current expenditures and current expenditures less transportation	Schools	.1627	.1616	.0261	.0362	9
Instructional costs	School district	.2520	.2470	.0610	.1790	58
Instructional costs (WADA)	School district	.3051	.2961	.0876	.1689	8
Total costs	School district	.1856	.1836	.0337	.2315	51
Total costs (WADA)	School district	-.0975	-.0975	.0095	.0557	2

Table 1 (continued)

Magnitude of Mean Correlation Between Educational Expenditures and Student Achievement Accounted for by Educational Expenditures

Expenditure definition	Level	z	r	r^2	SD	n
Current expenditures	School district	.0362	.0362	.0013	.3400	98
Current expenditures (WADA)	School district	.0693	.0693	.0048	.1870	8
Current expenditures less transportation	School district	.0063	.0063	.0000	.2444	61
Current expenditures less transportation (WADA)	School district	.0406	.0406	.0016	.1024	4
Excludes capital outlay and transportation	School district	.1193	.1183	.0139	.1713	18
Excludes transportation	School district	.0619	.0619	.0038	.0000	1
Excludes capital outlay	School district	.1918	.1895	.0359	.0000	1
Total costs less debt service and outgoing transfers	School district	.0501	.0501	.0025	.0284	2
Total costs less capital outlay, debt service, transportation, operation of plant, maintenance of plant, summer school, and adult education	School district	.1874	.1854	.0343	.0278	2
All expenditures	School district	.1078	.1078	.0116	.2730	314

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Table 2

Magnitude of Median Correlation Between Educational Expenditures and Student Achievement Accounted for by Educational Expenditures by Level of Data

Expenditure definition	Level	z	r	r^2	SD	n
Current expenditures, instructional costs, and total costs	School district and schools	.2341	.2301	.0529	.1410	17
Current expenditures	School district and schools	.2591	.2534	.0642	.1604	11
Instructional costs	School district	.1785	.1765	.0311	.0414	2
Total costs	School district	.1930	.1910	.0364	.1162	4
Current expenditures	School district	.2438	.2390	.0571	.1605	10
Current expenditures, instructional costs and total costs	School district	.2229	.2189	.0479	.1379	16
Current expenditures	Schools	.4118	.3900	.1521	.0000	1

grouping, grade level(s), quality score, sample size, and student grouping.

An important trend in the educational expenditure-student achievement relationship is the decline of the relationship over decades. Studies prior to 1960 had a mean r of .2528, for the studies conducted in the 1960s the mean r was .1593, and for the studies conducted in the 1970s the mean r was -.0413. This trend indicates that studies in recent decades indicate less of a relationship between achievement and expenditures than do earlier studies.

Does this meta-analysis provide a definite explanation of the relationship between expenditures and standard achievement? Probably not. While it may be the case that in recent decades a meta-analysis of studies finds little relationship between the two, it is also true that a number of possible factors which were not studied (and therefore not synthisezed) may affect the outcome of these studies. Method of study may account in part for these differences, so, too, may be the similarity in overall levels of spending during the later decades. It may be also that there is a level of spending above which expenditures no longer have a positive relationship. The effort to equalize per-pupil expenditures within states and to aid the disadvantaged through compensatory education might have helped achieve this level in the states studied in the 1970s. However, it may also be the case that the amount of financial aid needed for a positive relationship to student achievement in later decades has never been tested or studied since school districts do not have unlimited funds and all, even the most endowed, work within limits. A final explanation for these findings might be that while instructional costs aid in improving student achievement, other expenditures, while categorized

as educational expenditures, have little or no relationship to student achievement and are a major cause of the reported differences in expenditures between school districts.

It must also be noted that the student populations that were used in the studies were often quite different from the student populations upon which the achievement tests were normed. As a result, the same test might have been used to measure the achievement of students, but the test may not have been measuring the same achievement. The student populations were much larger and more diverse in the 1970s than in prior decades. Concomitantly, the number of programs offered in schools and the goals of schools steadily expanded during the 1970s created different priorities. Pupil retention was much greater in the 1970s, which might make studies of secondary school achievement scores noncomparable to earlier studies of a more limited and homogeneous sample. Finally, in none of these studies was class size considered a factor, a possible explanation of the low variance accounted for by educational expenditures upon student achievement.

Under what conditions does additional spending lead to higher achievement scores?

There were few conditions in which expenditures accounted for more than 4% of the variance. In studies which used mean correlations with school districts as the sample, instructional costs (n = 58) and instructional costs divided by weighted average daily attendance (n = 8) accounted for 6% and 9% of the variance, respectively, although instructional costs involving school districts and individuals (n = 124) accounted for only 2.5% of the variance. Although current expenditures accounted for 6% of the variance in studies using median correlations (n =

11), when contrasted to current expenditures in studies involving mean correlations (n = 112) which accounted for .1% of the variance, current expenditures cannot be considered as having a positive relationship to student achievement scores. School districts had greater student achievement gains from expenditures in math and science than from expenditures in language arts (see Tables 3 and 4). It has been shown from these studies that little of the variability in student achievement was accounted for by educational expenditures, although it may be the case that if school districts were not limited in their spending the variability in student achievement accounted for by educational expenditures might be greatly increased.

Does the effect of educational expenditures on student achievement interact with grade level?

There was no evidence of an interaction of grade level(s) with the educational expenditures-student achievement relationship (see Tables 5 and 6). There was no consistent pattern of the correlation of grade level(s) with the educational expenditures-student achievement relationship.

CONCLUSIONS AND RECOMMENDATIONS

This meta-analysis indicates that the relationship between student achievement and level of educational expenditures is minimal with those expenditures which relate directly to instruction, such as teacher salary and instructional supplies, having the most positive relationship to student achievement. There are a number of explanations of this finding. One may be that there is no relationship between how much or how little is spent and student achievement. Such a conclusion flies in the face of the experiences and beliefs of most educators. Obviously, if

Table 3

Magnitude of Mean Correlation Between Educational Expenditures and Student Achievement Accounted for by Achievement Grouping

Achievement	z	r	r^2	SD	n
Apprehension	.1848	.1828	.0334	.1203	13
Composite	.1551	.1541	.0237	.2316	94
Language arts	.0438	.0438	.0023	.2667	209
Math	.1646	.1630	.0265	.1923	73
Science	.1653	.1635	.0267	.3323	11

Table 4

Magnitude of Median Correlation Between Educational Expenditures and Student Achievement Accounted for by Achievement Grouping

Achievement	z	r	r^2	SD	n
Composite	.4118	.3900	.1521	.0000	1
Language arts	.1961	.1834	.0374	.1351	9
Math	.2575	.2525	.0637	.1443	7

Table 5

Magnitude of Mean Correlation Between Educational Expenditures and Student Achievement Accounted for by Grade Level

Grades(s)	z	r	r^2	SD	n
1	.1055	.1055	.0111	.0708	7
2	.1631	.1615	.0260	.0377	3
3	.0056	.0056	.0000	.2737	49
4	.3349	.3229	.1108	.2364	16
5	.0998	.0998	.0099	.1075	41
6	.0927	.0927	.0085	.2102	57
7	.3212	.3102	.0962	.1765	11
8	.1191	.1181	.0139	.3057	27
9	.0425	.0425	.0018	.2248	63
10	.3840	.3660	.1339	.0767	11
11	.0143	.0143	.0002	.3065	55
12	.1816	.1796	.0322	.2223	57
4,6,8	.0619	.0619	.0038	.0000	1a
4,8,12	-.0825	-.0825	.0068	.0601	2a
1-6	.0938	.0938	.0087	.2250	173
7-12	.1106	.1105	.0122	.2690	224

a not included in 1-6 or 7-12

Table 6

Magnitude of Median Correlation Between Educational Expenditures and Student Achievement Accounted for by Grade Levels

Grade(s)	z	r	r^2	SD	n
3	.4773	.4442	.1973	.0339	2
4	.4118	.3900	.1521	.0000	1
5	.1113	.1112	.0123	.0587	5
6	.1986	.1956	.0382	.1182	4
9	.2826	.2756	.0759	.0390	2
9,10,11,12	.2927	.2847	.0810	.0254	2
3-6	.2176	.2146	.0460	.1590	13
9-12	.2876	.2796	.0781	.0280	4

there were no money for books or teachers, there would be no schools and achievement would not exist. While such a condition is only hypothetical, so, too, is the other end of the spectrum. We have no studies comparing schools with unlimited dollars because such schools do not exist. What we do have are school districts that spend different amounts of money per pupil, but not enormously different amounts. Thus, we really do not know at what point expenditures make a difference since this study is bound by what exits and what has already been studied.

A more reasonable interpretation of the findings of this study might be that past a certain point, it may well be that the amount of money a school district spends is not so vital as how the money is spent. For instance, if a school district has a choice between renovating a gymnasium or purchasing a new math program for third grade students and providing teachers with inservice training to teach the math program, the renovation would most likely cost more, but the investment in the math program would most likely result in higher student achievement scores. Approximately two-thirds of the studies synthesized here were not designed to differentiate between these two kinds of expenditures, both were lumped together into one classification. For example, nearly half of the studies include transportation and insurance costs in their expenditure definition, and while these costs have greatly increased in recent decades, their influence upon achievement is questionable. On the other hand, a meta- analysis of the studies that examined instructional expenses resulted in the strongest positive relationship of expenditures to achievement.

The interpretation of the results of this meta-analysis points out that some of the output and results that are claimed for education are doubtless due to education other than that offered in the formal schools

(Clark, 1963). There is considerable evidence that non-school factors are important determinants of educational outcomes. While school is one environmental factor influencing educational performance, so, too, are the home, press, radio, television, and other cultural elements. Then, too, the outcome of schooling is affected by native ability. Perhaps student scores on achievement tests should be tempered by differences in innate ability and overall atmosphere of the student's home. Amount of gain and not just level of achievement was not always part of the design. Research needs to place greater emphasis on the educational expenditures-student achievement relationship in measuring the amount of gain that students have achieved. If the scores of students in one school are higher than the scores of students in another school, then it does not necessarily mean that the school with the higher scores is more effective since the school with the lower achievement scores may well have had greater increases in achievement. As pointed out by Dyer (1972), the students' level of performance from any phase of the educational system tells nothing in itself about how well the system is functioning. One needs to know, in addition, what the students have gained during the time they have been under instruction, how much of the gain may be reasonably attributed to instruction, and how much to factors beyond the reach of the school.

Another area of research that should be investigated is the indirect effect of expenditures on student achievement. The indirect effect of expenditures, as shown in the study of Bidwell and Kasarda (1975), influenced the structure and staff qualifications of the school districts involved, as well as having a substantial impact on student achievement.

Educators need to re-evaluate the influence of expenditures upon student achievement. It may well be the case where unless there are large increases in expenditures which relate to instruction, there will not be major gains in student achievement and the non-school factors may be the major determining factors in student achievement. Given the limitations placed upon increases in school budgets by some of the states, it is not realistic to expect large increases to be forthcoming. In light of this reality, educators need to look at expenditures and determine if they are best being utilized to bring about the development of students to include improved student achievement.

Although the evidence of this study indicated that within the parameters of the studies synthesized, overall educational expenditures had little effect on student achievement, the limitations of the original studies as well as the reality of the nature of school expenditures limit the usefulness of these findings. We cannot, for instance, say that large expenditures will not result in increased achievement. The study does suggest a positive relationship between money used for instructional purposes and increased student achievement. Educators need to look at how money is spent to best achieve the goals of school districts with respect to achievement and the other needs of school districts.

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